

**Samsung Secret**

Product Information

**Customer :****DATE : Feb. 24. 2012****SAMSUNG TFT-LCD****MODEL : LTA460HQ18**

The Information Described in this Specification is Preliminary and can be changed without prior notice

LCD Business

Samsung Electronics Co . , LTD.

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## Revision History

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| Date          | Rev. No | Page                                                 | Summary                                                                                                                                                                                                                                                                                                                                                     |
|---------------|---------|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dec. 20. 2011 | 000     | all                                                  | First issued                                                                                                                                                                                                                                                                                                                                                |
| Feb. 01. 2012 | 001     | 4<br>5<br>6<br>9<br>11<br>12<br>13<br>16<br>17<br>22 | Modify the module size_depth<br>Modify the maximum rating of shock<br>Update the optical characteristics<br>Update the electrical characteristics<br>Update the converter spec<br>Modify pin map of input signal<br>Modify the power sequence<br>Modify the parameter<br>Modify the 3D mode sequence<br>Modify the packing spec                             |
| Feb. 24. 2012 | 002     | 4<br>12<br><br>14<br>15<br>16                        | Revise the display colors 8bit to 10bit<br>Revise the input signal<br>- Pin no.7 : LVDS_sel → GND<br>Revise the note1)<br>- How to deal LVDS 4 <sup>th</sup> channel when the 8bit signal input from SET<br>Revise the LVDS interface (JEIDA only)<br>Gray scale is revised as 10bit standard<br>$t_{RSLM}$ , $t_{RSRM}$ is revised as 75MHz input standard |

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## General Description

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### Description

**LTA460HQ18** is a color active matrix liquid crystal display (LCD) that uses amorphous silicon TFT(Thin Film Transistor) as switching components. This model is composed of a TFT LCD panel, a driver circuit and a back light unit. The resolution of a 46.0" is 1920 x 1080 and this model can display up to 1.07 Billion colors with wide viewing angle of 89° or higher in all directions. This panel is intended to support applications to provide a excellent performance for Flat Panel Display such as Home-alone Multimedia TFT-LCD TV and High Definition TV

### Features

- RoHS compliance (Pb-free)
- High contrast ratio & aperture ratio with wide color gamut
- SVA(Super Vertical Align) mode
- Wide viewing angle ( $\pm 178^\circ$ )
- High speed response
- FHD resolution (16:9)
- Low Power consumption
- Edge Type LED (Light Emitted Diode) BLU
- DE (Data Enable) mode
- 2ch LVDS (Low Voltage Differential Signaling) interface

### General Information

| Items               | Specification          | Unit              | Note               |
|---------------------|------------------------|-------------------|--------------------|
| Module Size         | 1045.9(H) x 602.1 (V)  | mm                | $\pm 1.0\text{mm}$ |
|                     | 34.2 (D)               |                   | max                |
| Weight              | 12300                  | g                 | max                |
| Pixel Pitch         | 0.530 (H) x 0.530 (W)  | mm                |                    |
| Active Display Area | 1018.08(H) X 572.67(V) | mm                |                    |
| Surface Treatment   | Antiglare              |                   |                    |
| Display Colors      | 10bit                  | colors            |                    |
| Number of Pixels    | 1920 x 1080            | pixel             |                    |
| Pixel Arrangement   | RGB vertical stripe    |                   |                    |
| Display Mode        | Normally Black         |                   |                    |
| Luminance of White  | 400 (Typ.)             | cd/m <sup>2</sup> |                    |

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## 1. Absolute Maximum Ratings

If the condition exceeds maximum ratings, it can cause malfunction or unrecoverable damage to the device.

| Item                          | Symbol    | Min.    | Max. | Unit | Note    |
|-------------------------------|-----------|---------|------|------|---------|
| Power Supply Voltage          | $V_{DD}$  | GND-0.3 | 13.2 | V    | (1)     |
| Dimming Control               | Max. Lum  | -       | 5    | V    |         |
| Storage temperature           | $T_{STG}$ | -20     | 60   | °C   | (2)     |
| Operating temperature         | $T_{OPR}$ | 0       | 50   | °C   |         |
| Shock ( non - operating )     | X,Y       | -       | 40   | G    | (3),(5) |
|                               | Z         |         | 30   |      |         |
| Vibration ( non - operating ) | $V_{NOP}$ | -       | 1.5  | G    | (4),(5) |

Note (1)  $T_a = 25 \pm 2^\circ\text{C}$

(2) Temperature and relative humidity range are shown in the figure below.

a. 90 % RH Max. ( $T_a \leq 39^\circ\text{C}$ )

b. Relative Humidity is 90% or less. ( $T_a > 39^\circ\text{C}$ )

c. No condensation

(3) 11ms, sine wave, one time for  $\pm X, \pm Y, \pm Z$  axis

(4) 10-300 Hz, Sweep rate 10min, 30min for X,Y,Z axis

(5) A JIG used for test should be strong so that the module is not bent or twisted.

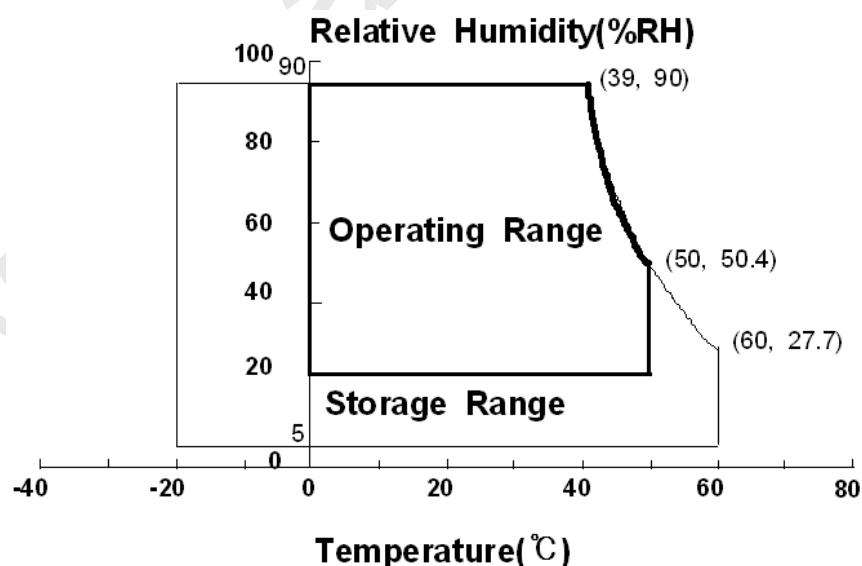


Fig. Temperature and Relative humidity range

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## 2. Optical Characteristics

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The optical characteristics should be measured in a dark room or equivalent.

Measuring equipment : TOPCON RD-80S, TOPCON SR-3, ELDIM EZ-Contrast

(Ta = 25 ± 2 °C, VDD=12V, fv= 60Hz, f<sub>DCLK</sub> = 148.5MHz)

| Item                                      |        | Symbol           | Condition                                                                 | Min.          | Typ.  | Max.          | Unit              | Note               |
|-------------------------------------------|--------|------------------|---------------------------------------------------------------------------|---------------|-------|---------------|-------------------|--------------------|
| Contrast Ratio<br>(Center of screen)      |        | C/R              |                                                                           | 3000          | 4000  | -             |                   | (1)<br>SR-3        |
| Response Time                             | G-to-G | Tg               | Normal<br>q <sub>L,R</sub> =0<br>q <sub>U,D</sub> =0<br><br>Viewing Angle | -             | 6     | 18            | msec              | (3)<br>RD-80S      |
| Luminance of White<br>(Center of screen)  |        | Y <sub>L</sub>   |                                                                           | 350           | 400   | -             | cd/m <sup>2</sup> | (4)<br>SR-3        |
| Color Chromaticity<br>(CIE 1931)          | Red    | Rx               |                                                                           | TYP.<br>-0.03 | 0.650 | TYP.<br>+0.03 |                   | (5),(6)<br>SR-3    |
|                                           |        | Ry               |                                                                           |               | 0.330 |               |                   |                    |
|                                           | Green  | Gx               |                                                                           |               | 0.310 |               |                   |                    |
|                                           |        | Gy               |                                                                           |               | 0.600 |               |                   |                    |
|                                           | Blue   | Bx               |                                                                           |               | 0.150 |               |                   |                    |
|                                           |        | By               |                                                                           |               | 0.060 |               |                   |                    |
|                                           | White  | Wx               |                                                                           |               | 0.280 |               |                   |                    |
|                                           |        | Wy               |                                                                           |               | 0.290 |               |                   |                    |
| Color Gamut                               |        | -                |                                                                           | -             | 70    | -             | %                 | (5)<br>SR-3        |
| Color Temperature                         |        | -                |                                                                           | 7000          | 10000 | -             | K                 |                    |
| Viewing Angle                             | Hor.   | q <sub>L</sub>   | C/R≥10                                                                    | 75            | 89    | -             | Degree            | (6)<br>EZ-Contrast |
|                                           |        | q <sub>R</sub>   |                                                                           | 75            | 89    | -             |                   |                    |
|                                           | Ver.   | q <sub>U</sub>   |                                                                           | 75            | 89    | -             |                   |                    |
|                                           |        | q <sub>D</sub>   |                                                                           | 75            | 89    | -             |                   |                    |
| White Brightness Uniformity<br>(9 Points) |        | B <sub>uni</sub> |                                                                           | -             | -     | 25            | %                 | (2)<br>SR-3        |

### - Test Equipment Setup

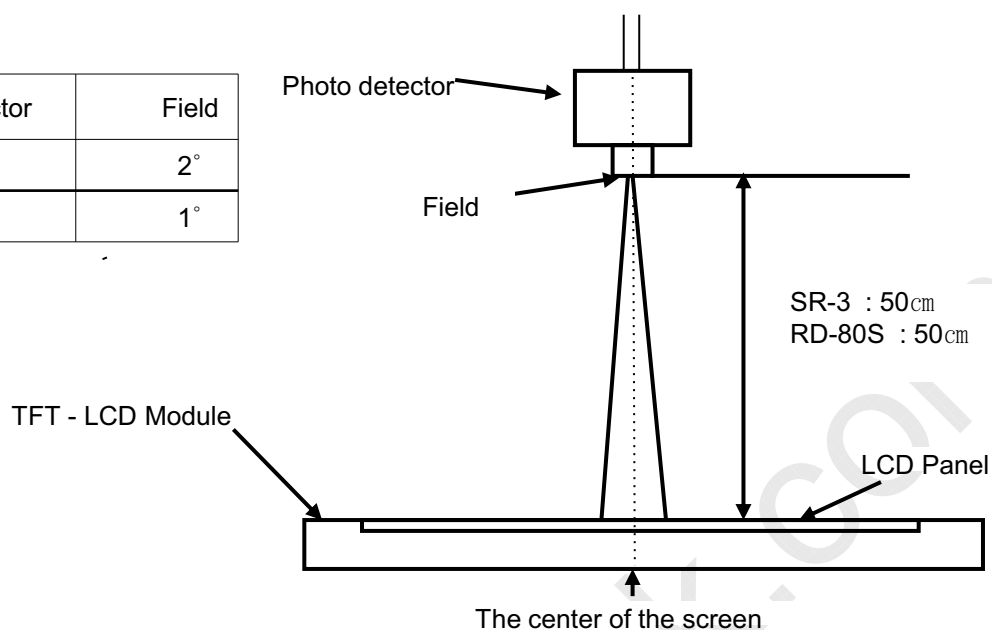
The measurement should be executed in a stable, windless and dark room between 40min and 60min after lighting the back light at the given temperature for stabilization of the back light. This should be measured in the center of screen.

Environment condition : Ta = 25 ± 2 °C

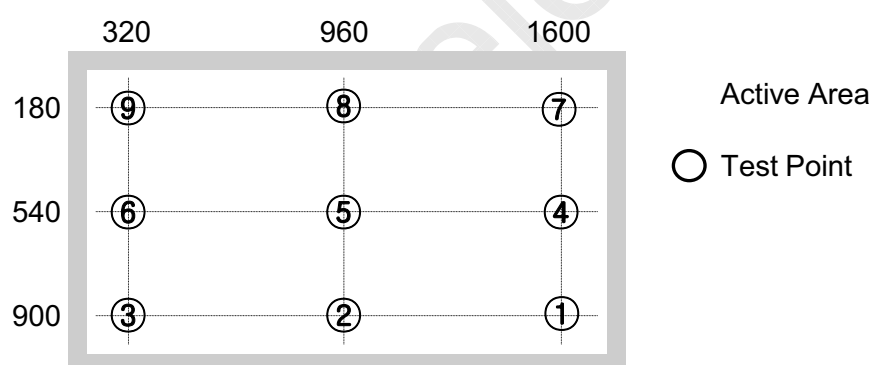
|       |            |         |                   |      |        |
|-------|------------|---------|-------------------|------|--------|
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| Photo detector | Field |
|----------------|-------|
| SR-3           | 2°    |
| RD-80S         | 1°    |



#### - Definition of test point



#### Note (1) Definition of Contrast Ratio (C/R)

: Ratio of gray max (Gmax) & gray min (Gmin) at the center point ⑤ of the panel

$$C/R = \frac{G_{\max}}{G_{\min}}$$

Gmax : Luminance with all pixels white

Gmin : Luminance with all pixels black

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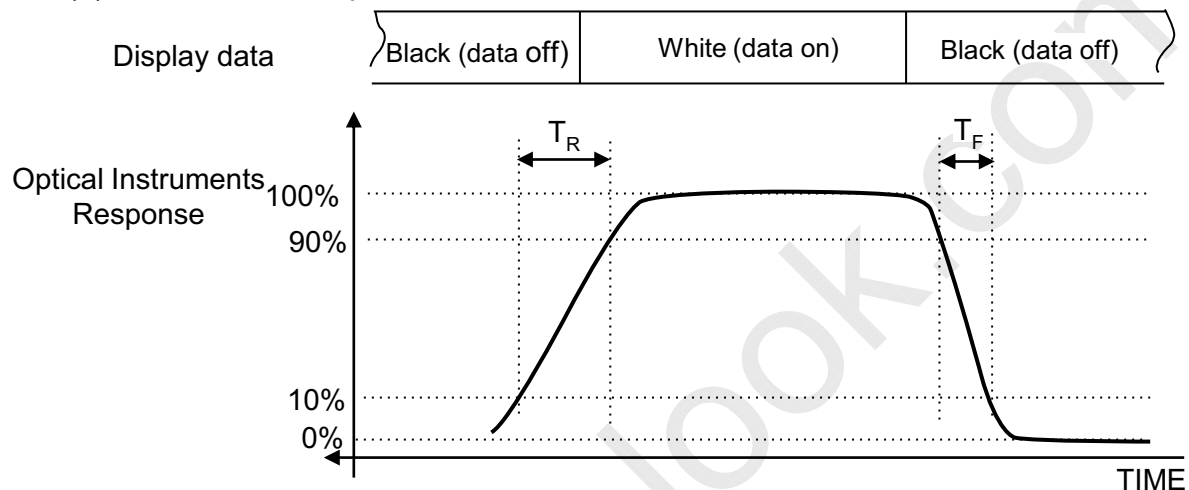
Note (2) Definition of 9 points brightness uniformity (Test pattern : Full White )

$$B_{uni} = 100 * \frac{(B_{max} - B_{min})}{B_{max}}$$

Bmax : Maximum brightness

Bmin : Minimum brightness

Note (3) Definition of Response time : Sum of Tr, Tf



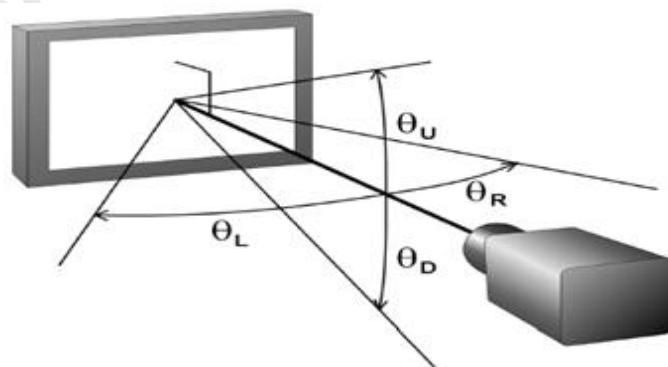
Note (4) Definition of Luminance of White : Luminance of white at center point ⑤

Note (5) Definition of Color Chromaticity (CIE 1931)

Color coordinate of Red, Green, Blue & White at center point ⑤

Note (6) Definition of Viewing Angle

: Viewing angle range (C/R  $\geq 10$ )





### 3. Electrical Characteristics

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#### 3.1 TFT LCD Module

The connector for display data & timing signal should be connected.

$T_a = 25^{\circ}\text{C} \pm 2^{\circ}\text{C}$

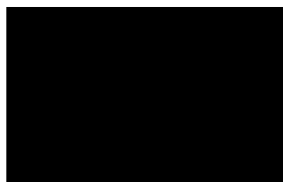
| Item                    |           | Symbol            | Min. | Typ.  | Max.  | Unit | Note    |
|-------------------------|-----------|-------------------|------|-------|-------|------|---------|
| Voltage of Power Supply |           | V <sub>DD</sub>   | 10.8 | 12.0  | 13.2  | V    | (1)     |
| Current of Power Supply | (a) Black | I <sub>DD</sub>   | -    | 550   | 700   | mA   | (2),(3) |
|                         | (b) White |                   | -    | 650   | 850   | mA   |         |
|                         | (c) N-PTN |                   | -    | 1100  | 1500  | mA   |         |
| Vsync Frequency         |           | f <sub>V</sub>    | 48   | 60    | 62.5  | Hz   |         |
| Hsync Frequency         |           | f <sub>H</sub>    | 60   | 67.5  | 70    | kHz  |         |
| Main Frequency          |           | f <sub>DCLK</sub> | 130  | 148.5 | 152.5 | MHz  |         |
| Rush Current            |           | I <sub>RUSH</sub> | -    | -     | 4     | A    | (4)     |

Note (1) The ripple voltage should be controlled under 10% of  $V_{DD}$ .

(2)  $f_V=60\text{Hz}$ ,  $f_{DCLK} = 148.5\text{MHz}$ ,  $V_{DD} = 12.0\text{V}$ , DC Current.

(3) Power dissipation check pattern (LCD Module only)

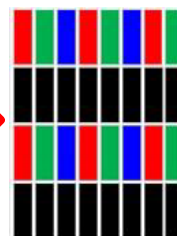
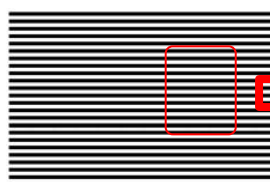
a) Black Pattern



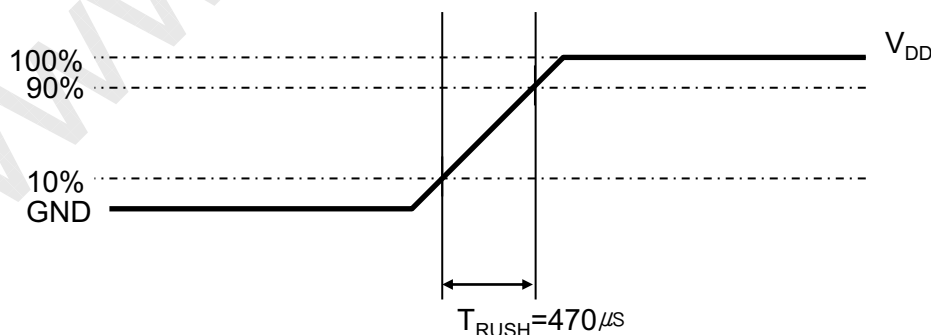
b) White Pattern



c) N - PTN



(4) Measurement Conditions



Rush Current  $I_{RUSH}$  can be measured when  $T_{RUSH}$  is  $470\mu\text{s}$ .

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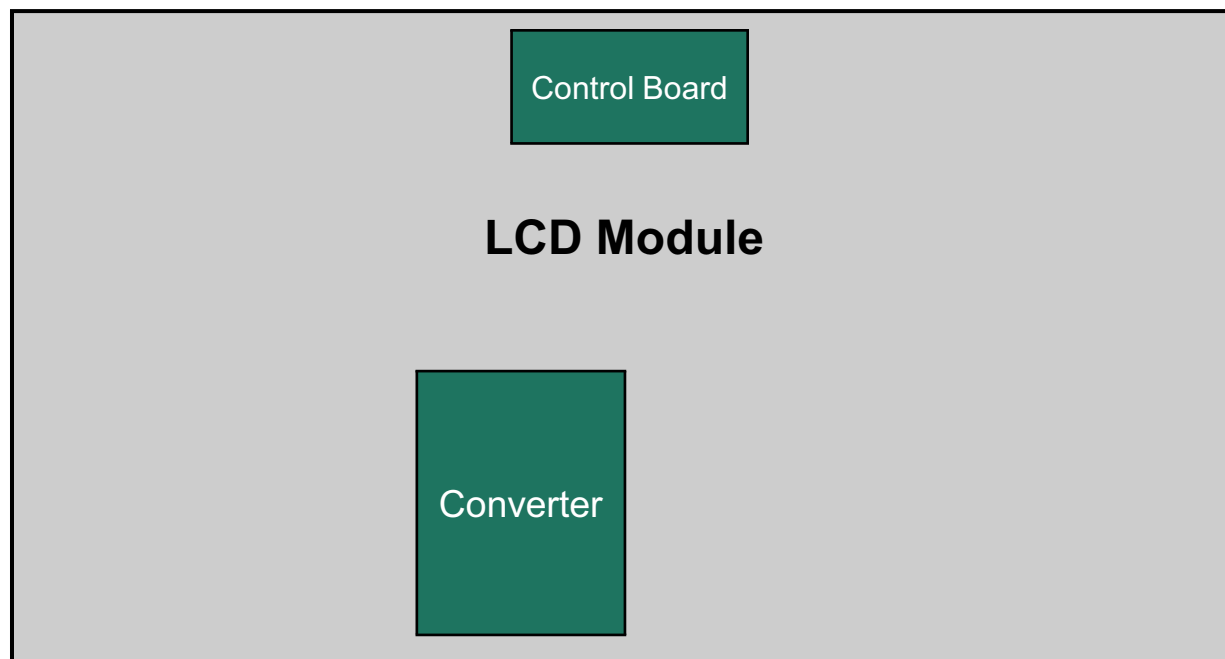
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### 3.2 Back Light Unit

The back light unit contains Edge type White LEDs (Light Emitting Diode)

Ta=25 ± 2°C



| Item                | Symbol | Min.   | Typ. | Max. | Unit | Note |
|---------------------|--------|--------|------|------|------|------|
| Operating Life Time | Hr     | 30,000 | -    | -    | Hour | (1)  |

Note (1) It is defined as the time to take until the brightness reduces to 50% of its original value.

[Operating condition : Ta = 25±2°C , For LED package only]

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## 3.3 Converter Input Condition &amp; Specification

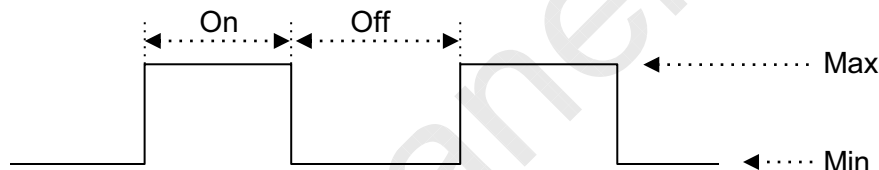
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| Items                            | Symbol              | Conditions                                           | Specifications |      |      | Unit | Note       |
|----------------------------------|---------------------|------------------------------------------------------|----------------|------|------|------|------------|
|                                  |                     |                                                      | Min.           | Typ. | Max. |      |            |
| Input Voltage                    | V <sub>in</sub>     | -                                                    | 22             | 24   | 26   | V    | Ta=25±2 °C |
| Input Current                    | I <sub>RUSH</sub>   | V <sub>in</sub> =24.0V<br>V <sub>dim</sub> =3.3V     | -              | -    | 4.80 | A    | Normal     |
| Backlight On/Off                 | ON                  | V <sub>in</sub> =24.0 V                              | 3              | -    | 5.25 | V    | Note(2)    |
|                                  | OFF                 | V <sub>in</sub> =24.0 V                              | 0              | -    | 0.4  |      |            |
| Dimming Range                    | V <sub>DIM</sub>    | V <sub>in</sub> :22~26V                              | 0              | -    | 3.3  | V    |            |
| Dimming Duty Output              | D max               | V <sub>in</sub> =24V Dim:3.3V                        | -              | -    | 100  | %    |            |
|                                  | D min               | V <sub>in</sub> =24V Dim:0V                          | 1              | -    | -    |      |            |
| Dimming Frequency                | F <sub>PWM</sub>    | V <sub>in</sub> =24.0 V                              | 140            | 150  | 160  | Hz   |            |
| External Dimming Duty Range      | EX_Dim              | V <sub>in</sub> =22.0~26.0 V<br>Dim Pin(#13):floting | 1              | -    | 100  | %    |            |
| External Dimming Frequency Range | F <sub>EX_PWM</sub> |                                                      | -              | 150  | -    | Hz   |            |
| External Dimming Signal Level    | V <sub>PWM</sub>    | High (ON)                                            | 3              | -    | 5.25 | V    |            |
|                                  |                     | Low (Off)                                            | 0              | -    | 0.4  |      |            |

Note (1) All data is measured after 120min warm-up.

Note (2) V<sub>Dim</sub> and Ex\_Dim are available only at Normal 2D mode. (3D ENA = OFF)

Note (3) Duty = On / (On+Off) \* 100



- Additional Appendix for Supply Current (Only for Reference\_2D mode)

| Items                          | Symbol           | Conditions                                                | Min. | Typ.  | Max.  | Unit |
|--------------------------------|------------------|-----------------------------------------------------------|------|-------|-------|------|
| Input Current                  | lin _ overshoot  | V <sub>in</sub> = 24V, Dim=3.3V<br>(Within 1hr at BLU on) | -    | 3.76  | 3.87  | A    |
|                                | lin _ saturation | V <sub>in</sub> = 24V, Dim=3.3V<br>(After 1hr Aging)      | -    | 3.22  | 3.32  | A    |
| Power Consumption (Back light) | P _ Inrush       | V <sub>in</sub> =24.0V, V <sub>dim</sub> = 3.3V           | -    | -     | 115.2 | Watt |
|                                | P _ overshoot    | V <sub>in</sub> = 24V, Dim=3.3V<br>(Within 1hr at BLU on) | -    | 90.24 | 92.88 | Watt |
|                                | P _ saturation   | V <sub>in</sub> = 24V, Dim=3.3V<br>(After 1hr Aging)      | -    | 77.28 | 79.68 | Watt |

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## 4. Input Terminal Pin Assignment

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### 4.1 Input Signal & Power

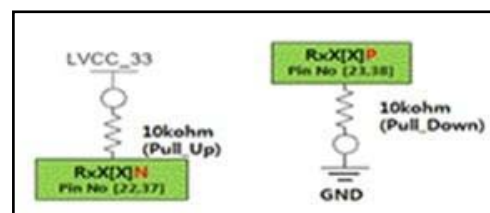
| Pin | Description       | Pin | Description       |
|-----|-------------------|-----|-------------------|
| 1   | NC                | 26  | 3D EN             |
| 2   | NC                | 27  | NC                |
| 3   | NC                | 28  | Rx2[0]N           |
| 4   | NC                | 29  | Rx2[0]P           |
| 5   | 3D_Sync_O         | 30  | Rx2[1]N           |
| 6   | GND               | 31  | Rx2[1]P           |
| 7   | GND               | 32  | Rx2[2]N           |
| 8   | NC                | 33  | Rx2[2]P           |
| 9   | NC                | 34  | GND               |
| 10  | NC                | 35  | Rx2CLKN           |
| 11  | GND               | 36  | Rx2CLKP           |
| 12  | Rx1[0]N           | 37  | GND               |
| 13  | Rx1[0]P           | 38  | Rx2[3]N           |
| 14  | Rx1[1]N           | 39  | Rx2[3]P           |
| 15  | Rx1[1]P           | 40  | Rx2[4]N *note (1) |
| 16  | Rx1[2]N           | 41  | Rx2[4]P *note (1) |
| 17  | Rx1[2]P           | 42  | NC                |
| 18  | GND               | 43  | NC                |
| 19  | Rx1CLKN           | 44  | GND               |
| 20  | Rx1CLKP           | 45  | GND               |
| 21  | GND               | 46  | GND               |
| 22  | Rx1[3]N           | 47  | NC                |
| 23  | Rx1[3]P           | 48  | VCC               |
| 24  | Rx1[4]N *note (1) | 49  | VCC               |
| 25  | Rx1[4]P *note (1) | 50  | VCC               |
|     |                   | 51  | VCC               |

Note(1) If 8bit of LVDS signal input from SET,  
Keep [4]channel **level '0'**



Note(2) 3D format is set with interleave function only

Note(3) NC : No connection, Pins are used only for SEC.



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## 4.2. Converter Input Pin Configuration

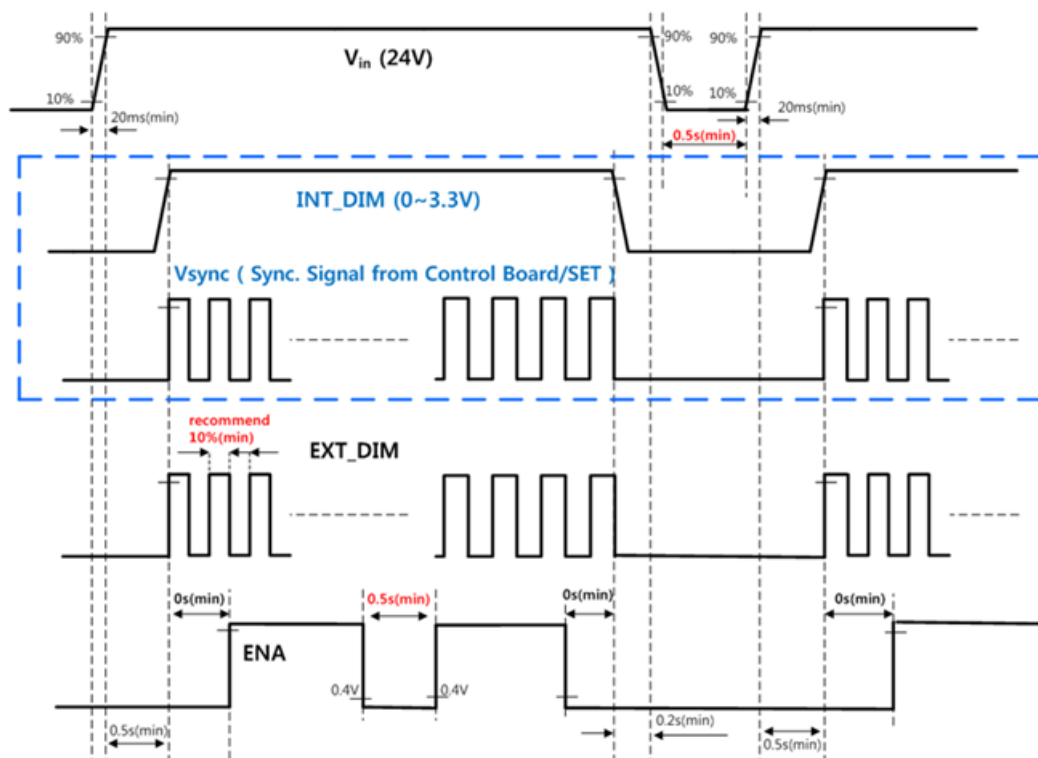
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Connector : Yeon-ho, 20022WR-014B1

| Pin No. | Pin Configuration(FUNCTION)                               |
|---------|-----------------------------------------------------------|
|         | Master                                                    |
| 1 ~5    | 24 V                                                      |
| 6~10    | GND                                                       |
| 11      | Converter operation status Output                         |
| 12      | Converter On /Off Control [ON:3 – 5.25 V, OFF: 0 - 0.4 V] |
| 13      | Internal Dimming Control [0V:Min, 3.3V:Max] *Note(1)      |
| 14      | External PWM [1~100 %] *Note(1)                           |

Note(1) If use Dimming Control, Pin 14 Must be N.C  
 If use External PWM, Pin 13 Must be N.C

## 4.3. Converter Input Power Sequence



Note) SEQUENCE : ON = V<sub>in</sub>(24V) > Dimming Control ≥ Backlight On/Off  
 OFF = Backlight On/Off ≥ Dimming Control > V<sub>in</sub>(24V)

## 4.4 LVDS Interface

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- LVDS Receiver : T-con (merged)
- Data Format (JEIDA only)

|             | LVDS pin     | JEIDA -DATA |
|-------------|--------------|-------------|
| TxOUT/RxIN0 | TxIN/RxOUT0  | R4          |
|             | TxIN/RxOUT1  | R5          |
|             | TxIN/RxOUT2  | R6          |
|             | TxIN/RxOUT3  | R7          |
|             | TxIN/RxOUT4  | R8          |
|             | TxIN/RxOUT6  | R9          |
|             | TxIN/RxOUT7  | G4          |
| TxOUT/RxIN1 | TxIN/RxOUT8  | G5          |
|             | TxIN/RxOUT9  | G6          |
|             | TxIN/RxOUT12 | G7          |
|             | TxIN/RxOUT13 | G8          |
|             | TxIN/RxOUT14 | G9          |
|             | TxIN/RxOUT15 | B4          |
|             | TxIN/RxOUT18 | B5          |
| TxOUT/RxIN2 | TxIN/RxOUT19 | B6          |
|             | TxIN/RxOUT20 | B7          |
|             | TxIN/RxOUT21 | B8          |
|             | TxIN/RxOUT22 | B9          |
|             | TxIN/RxOUT24 | HSYNC       |
|             | TxIN/RxOUT25 | VSNC        |
|             | TxIN/RxOUT26 | DEN         |
| TxOUT/RxIN3 | TxIN/RxOUT27 | R2          |
|             | TxIN/RxOUT5  | R3          |
|             | TxIN/RxOUT10 | G2          |
|             | TxIN/RxOUT11 | G3          |
|             | TxIN/RxOUT16 | B2          |
|             | TxIN/RxOUT17 | B3          |
|             | TxIN/RxOUT23 | RESERVED    |
| TxOUT/RxIN4 | TxIN/RxOUT28 | R0          |
|             | TxIN/RxOUT29 | R1          |
|             | TxIN/RxOUT30 | G0          |
|             | TxIN/RxOUT31 | G1          |
|             | TxIN/RxOUT32 | B0          |
|             | TxIN/RxOUT33 | B1          |
|             | TxIN/RxOUT34 | RESERVED    |

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**Samsung Secret**

#### 4.5 Input Signals, Basic Display Colors and Gray Scale of Each Color

| COLOR                        | DISPLAY<br>(10bit) | DATA SIGNAL |    |    |    |    |    |    |    |    |    |       |    |    |    |    |    |    |    |    |    |      |    |    |    |    |    |    |    | GRAY<br>SCALE<br>LEVEL |    |              |
|------------------------------|--------------------|-------------|----|----|----|----|----|----|----|----|----|-------|----|----|----|----|----|----|----|----|----|------|----|----|----|----|----|----|----|------------------------|----|--------------|
|                              |                    | RED         |    |    |    |    |    |    |    |    |    | GREEN |    |    |    |    |    |    |    |    |    | BLUE |    |    |    |    |    |    |    |                        |    |              |
|                              |                    | R0          | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | G0    | G1 | G2 | G3 | G4 | G5 | G6 | G7 | G8 | G9 | B0   | B1 | B2 | B3 | B4 | B5 | B6 | B7 |                        | B8 | B9           |
| BASIC<br>COLOR               | BLACK              | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0                      | -  |              |
|                              | BLUE               | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1                      | -  |              |
|                              | GREEN              | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0                      | -  |              |
|                              | CYAN               | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1                      | -  |              |
|                              | RED                | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0                      | -  |              |
|                              | MAGENTA            | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1                      | 1  | -            |
|                              | YELLOW             | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0                      | 0  | -            |
|                              | WHITE              | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1                      | 1  | -            |
| GRAY<br>SCALE<br>OF<br>RED   | BLACK              | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0                      | R0 |              |
|                              | DARK<br>↑          | 1           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0                      | R1 |              |
|                              |                    | 0           | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0                      | 0  | R2           |
|                              |                    | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  | :                      | :  | R3~<br>R1020 |
|                              |                    | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  | :                      |    |              |
|                              | ↓<br>LIGHT         | 1           | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0                      | 0  | R1021        |
|                              |                    | 0           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0                      | 0  | R1022        |
|                              | RED                | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0                      | 0  | R1023        |
| GRAY<br>SCALE<br>OF<br>GREEN | BLACK              | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0                      | G0 |              |
|                              | DARK<br>↑          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0                      | 0  | G1           |
|                              |                    | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0                      | 0  | G2           |
|                              |                    | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  | :                      | :  | G3~<br>G1020 |
|                              |                    | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  | :                      |    |              |
|                              | ↓<br>LIGHT         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0                      | 0  | G1021        |
|                              |                    | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0                      | 0  | G1022        |
|                              | GREEN              | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0                      | 0  | G1023        |
| GRAY<br>SCALE<br>OF<br>BLUE  | BLACK              | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0                      | B0 |              |
|                              | DARK<br>↑          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0                      | 0  | B1           |
|                              |                    | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0                      | 0  | B2           |
|                              |                    | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  | :                      | :  | B3~<br>B1020 |
|                              |                    | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  | :                      |    |              |
|                              | ↓<br>LIGHT         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1                      | 1  | B1021        |
|                              |                    | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1                      | 1  | B1022        |
|                              | BLUE               | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1                      | 1  | B1023        |

Note) Definition of Gray :

Rn : Red Gray, Gn : Green Gray, Bn : Blue Gray (n = Gray level)

Input Signal : 0 = Low level voltage, 1 = High level voltage

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## 5. Interface Timing

### 5.1 Timing Parameters (DE mode)

| SIGNAL                  | ITEM                  | SYMBOL   | MIN. | TYP.  | MAX.  | Unit   | NOTE |
|-------------------------|-----------------------|----------|------|-------|-------|--------|------|
| Clock                   | Frequency             | $1/T_C$  | 130  | 148.5 | 152.5 | MHz    | -    |
| Hsync                   |                       | $F_H$    | 60   | 67.5  | 70    | KHz    | -    |
| Vsync                   |                       | $F_V$    | 48   | 60    | 62.5  | Hz     | -    |
| Vertical Display Term   | Active Display Period | $T_{VD}$ | -    | 1080  | -     | Lines  | -    |
|                         | Vertical Total        | $T_V$    | 1110 | 1125  | 1400  | Lines  | -    |
| Horizontal Display Term | Active Display Period | $T_{HD}$ | -    | 1920  | -     | Clocks | -    |
|                         | Horizontal Total      | $T_H$    | 2092 | 2200  | 2348  | clocks | -    |

Note) This product is DE mode. But the Hsync & Vsync signal must be inputted

- (1) Test Point : TTL control signal and CLK at LVDS Tx input terminal in system
- (2) Internal VDD = 3.3V
- (3) Spread spectrum
  - Modulation rate (max) :  $\pm 1.5\%$
  - Modulation Frequency : under 100KHz

### 5.2 LVDS Input Data Characteristics

| ITEM                       |                        | SYMBOL            | Min. | Typ. | Max. | UNIT | NOTE |
|----------------------------|------------------------|-------------------|------|------|------|------|------|
| Input Data Position        | F <sub>IN</sub> =75MHz | t <sub>RSRM</sub> | -    | -    | 500  | ps   |      |
|                            |                        | t <sub>RSLM</sub> | -500 | -    | -    | Ps   |      |
| Input common mode voltage  |                        | V <sub>CM</sub>   | 0.3  | -    | 1.8  | V    | -    |
| Differential Input Voltage |                        | V <sub>ID</sub>   | 100  | -    | 600  | mV   | -    |

Note) When the skew is measured the Spread Spectrum should be 0%

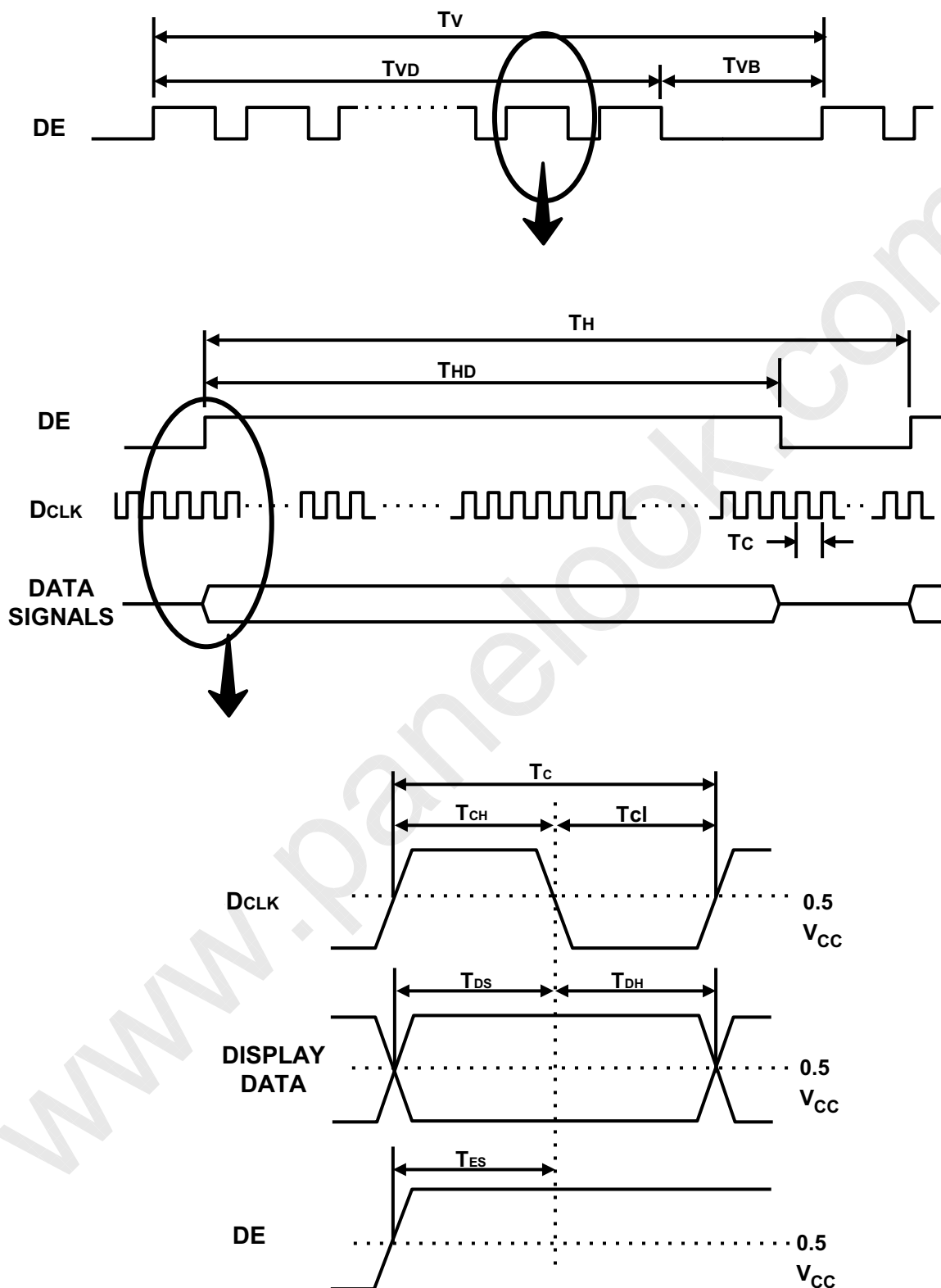


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| Timing | Spec (ms) |      |     | Description                                                                       |
|--------|-----------|------|-----|-----------------------------------------------------------------------------------|
|        | Min.      | Typ. | Max |                                                                                   |
| T7     | ≥ 42      |      |     | Backlight should be on after 10 frame when 3D signal input from SET               |
| T8     | ≥ 30      |      |     | Backlight should be off after 7 frame when 3D signal change to 2D signal from SET |

## 5. 4 Timing diagrams of interface signal ( DE mode )

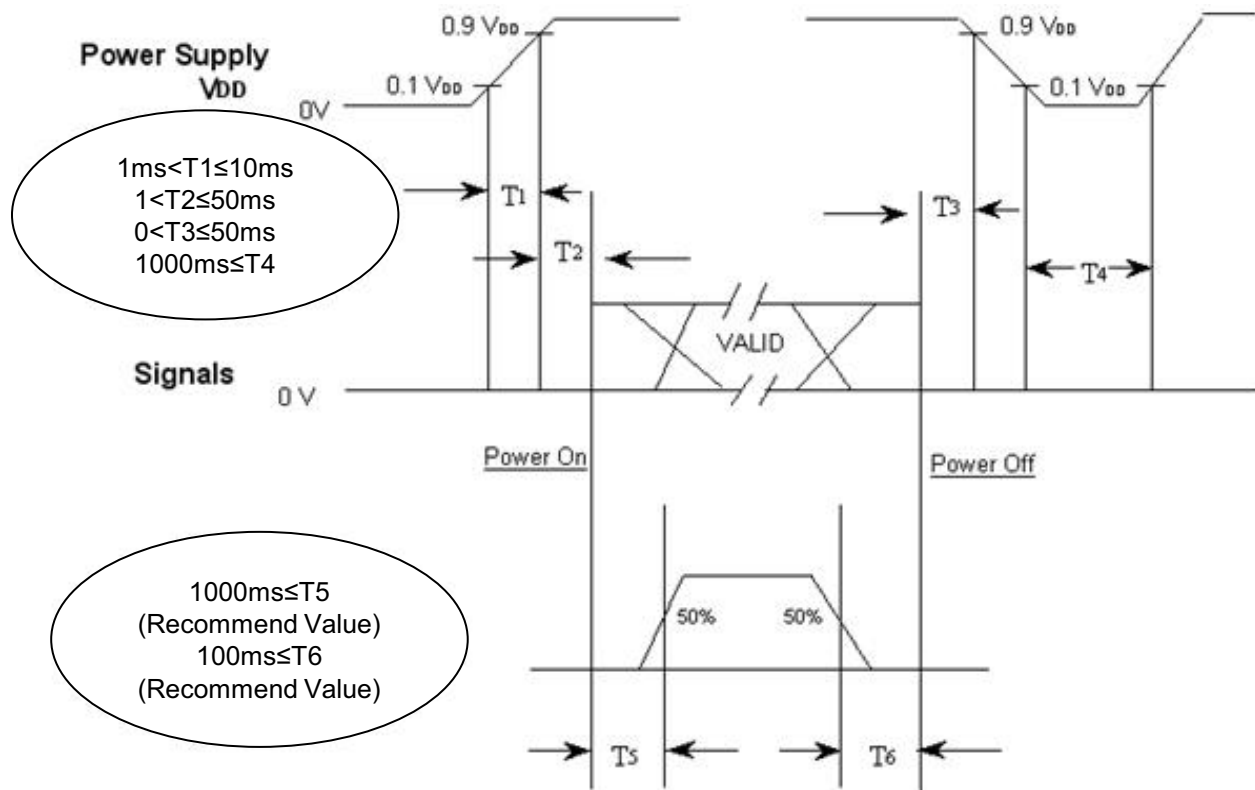
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## 5.5 Power ON/OFF Sequence

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To prevent a latch-up or DC operation of the LCD Module, the power on/off sequence should be as the diagram below.



T1 : V<sub>DD</sub> rising time from 10% to 90%

T2 : The time from V<sub>DD</sub> to valid data at power ON.

T3 : The time from valid data off to V<sub>DD</sub> off at power Off.

T4 : V<sub>DD</sub> off time for Windows restart

T5 : The time from valid data to B/L enable at power ON.

T6 : The time from valid data off to B/L disable at power Off.

- The supply voltage of the external system for the Module input should be the same as the definition of V<sub>DD</sub>.
- Apply the lamp voltage within the LCD operation range. When the back light turns on before the LCD operation or the LCD turns off before the back light turns off, the display may momentarily show abnormal screen.
- In case of V<sub>DD</sub> = off level, please keep the level of input signals low or keep a high impedance.
- T4 should be measured after the Module has been fully discharged between power off and on period.
- Interface signal should not be kept at high impedance when the power is on.
- In Case T5 is less than 1000msec and T6 is less than 100msec, Garbage Display can be seen. (It is not related to electrical function issue, Just for recommendation to prevent Garbage Display )

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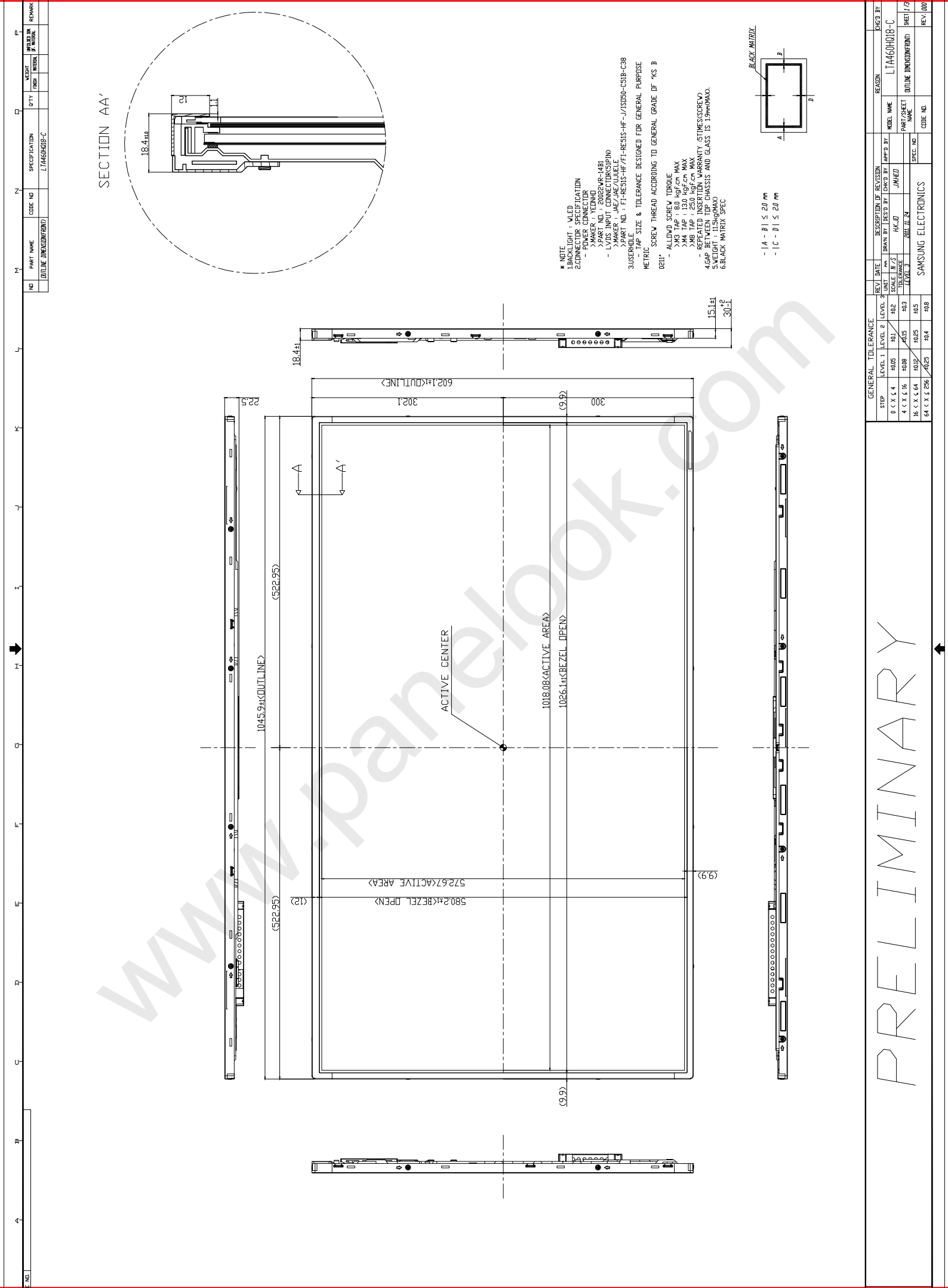
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BLACK MATRIX

18.4±1

302.1

602.1±0.20 (OUTLINE)

300

(9.9)

1018.08<ACTIVE AREA>

1026.14<BEZEL OPEN>

572.67<ACTIVE AREA>

580.24<BEZEL OPEN>

(12)

(522.95)

1045.94<OUTLINE>

22.5

15.14±1

30±1

18.4±1

302.1

602.1±0.20 (OUTLINE)

300

(9.9)

1018.08<ACTIVE AREA>

1026.14<BEZEL OPEN>

572.67<ACTIVE AREA>

580.24<BEZEL OPEN>

(12)

(522.95)

1045.94<OUTLINE>

22.5

15.14±1

30±1

18.4±1

302.1

602.1±0.20 (OUTLINE)

300

(9.9)

1018.08<ACTIVE AREA>

1026.14<BEZEL OPEN>

572.67<ACTIVE AREA>

580.24<BEZEL OPEN>

(12)

(522.95)

1045.94<OUTLINE>

22.5

15.14±1

30±1

18.4±1

302.1

602.1±0.20 (OUTLINE)

300

(9.9)

1018.08<ACTIVE AREA>

1026.14<BEZEL OPEN>

572.67<ACTIVE AREA>

580.24<BEZEL OPEN>

(12)

(522.95)

1045.94<OUTLINE>

22.5

15.14±1

30±1

18.4±1

302.1

602.1±0.20 (OUTLINE)

300

(9.9)

1018.08<ACTIVE AREA>

1026.14<BEZEL OPEN>

572.67<ACTIVE AREA>

580.24<BEZEL OPEN>

(12)

(522.95)

1045.94<OUTLINE>

22.5

15.14±1

30±1

18.4±1

302.1

602.1±0.20 (OUTLINE)

300

(9.9)

1018.08<ACTIVE AREA>

1026.14<BEZEL OPEN>

572.67<ACTIVE AREA>

580.24<BEZEL OPEN>

(12)

(522.95)

1045.94<OUTLINE>

22.5

15.14±1

30±1

18.4±1

302.1

602.1±0.20 (OUTLINE)

300

(9.9)

1018.08<ACTIVE AREA>

1026.14<BEZEL OPEN>

572.67<ACTIVE AREA>

580.24<BEZEL OPEN>

(12)

(522.95)

1045.94<OUTLINE>

22.5

15.14±1

30±1

18.4±1

302.1

602.1±0.20 (OUTLINE)

300

(9.9)

1018.08<ACTIVE AREA>

1026.14<BEZEL OPEN>

572.67<ACTIVE AREA>

580.24<BEZEL OPEN>

(12)

(522.95)

1045.94<OUTLINE>

22.5

15.14±1

30±1

GENERAL TOLERANCE

REV

DATE

UNIT

LEVEL 1

LEVEL 2

LEVEL 3

SCALE 1/10

SCALE 1/20

SCALE 1/40

SCALE 1/80

SCALE 1/160

SCALE 1/320

SCALE 1/640

SCALE 1/1280

SCALE 1/2560

SCALE 1/5120

SCALE 1/10240

SCALE 1/20480

SCALE 1/40960

SCALE 1/81920

SCALE 1/163840

SCALE 1/327680

SCALE 1/655360

SCALE 1/1310720

SCALE 1/2621440

SCALE 1/5242880

SCALE 1/10485760

SCALE 1/20971520

SCALE 1/41943040

SCALE 1/83886080

SCALE 1/167772160

SCALE 1/335544320

SCALE 1/671088640

SCALE 1/1342177280

SCALE 1/2684354560

SCALE 1/5368709120

SCALE 1/10737418240

SCALE 1/21474836480

SCALE 1/42949672960

SCALE 1/85899345920

SCALE 1/171798691840

SCALE 1/343597383680

SCALE 1/687194767360

SCALE 1/1374389534720

SCALE 1/2748779069440

SCALE 1/5497558138880

SCALE 1/10995116277760

SCALE 1/21990232555520

SCALE 1/43980465111040

SCALE 1/87960930222080

SCALE 1/175921860444160

SCALE 1/351843720888320

SCALE 1/703687441776640

SCALE 1/1407374883553280

SCALE 1/2814749767106560

SCALE 1/5629499534213120

SCALE 1/11258999068426240

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SCALE 1/180143985094819840

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SCALE 1/1441151880758558720

SCALE 1/2882303761517117440

SCALE 1/5764607523034234880

SCALE 1/11529215046068469760

SCALE 1/23058430092136939520

SCALE 1/46116860184273879040

SCALE 1/92233720368547758080

SCALE 1/184467440737095516160

SCALE 1/368934881474191032320

SCALE 1/737869762948382064640

SCALE 1/1475739525896764129280

SCALE 1/2951479051793528258560

SCALE 1/5902958103587056517120

SCALE 1/11805916207174113034240

SCALE 1/23611832414348226068480

SCALE 1/47223664828696452136960

SCALE 1/94447329657392904273920

SCALE 1/188894659314785808547840

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SCALE 1/1511157274518286468382720

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SCALE 1/1547425049106725343623905280

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SCALE 1/12676506002282294014967032053760

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SCALE 1/1622592768292133633915780102881280

SCALE 1/3245185536584267267831560205762560

SCALE 1/6490371073168534535663120411525120

SCALE 1/12980742146337069071326240823050240

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SCALE 1/207691874341393105141219853168803840

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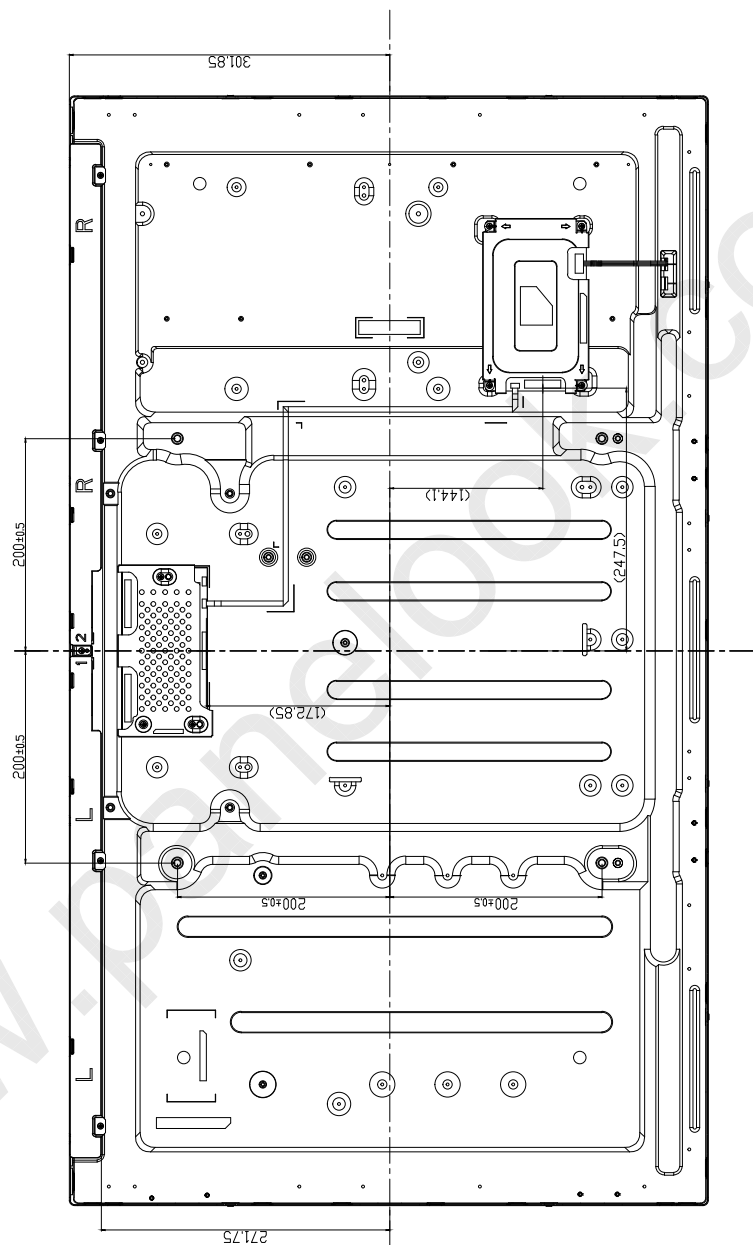
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# PRELIMINARY

**Samsung Secret**

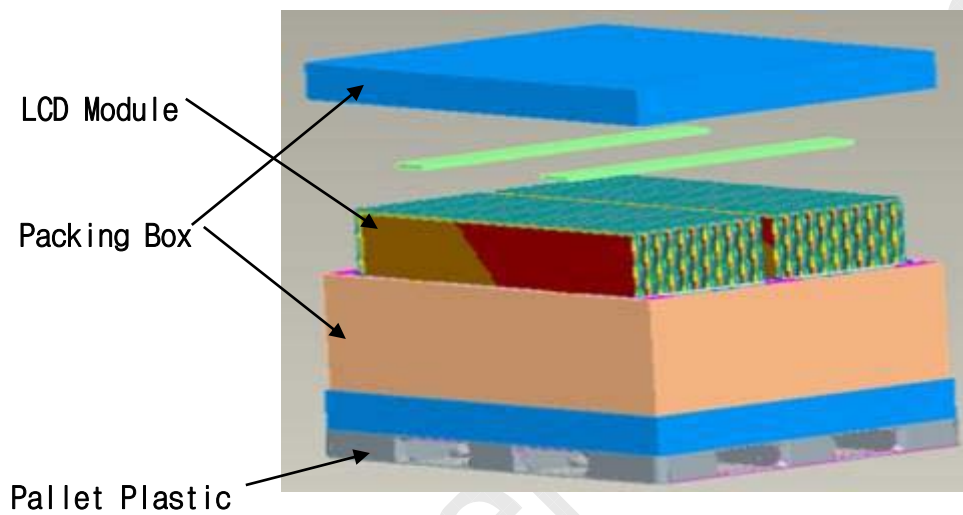
## 7. PACKING

### 7.1 CARTON (Internal Package)

#### (1) Packing Form

Corrugated fiberboard box and EPS cushion as shock absorber

#### (2) Packing Method



### 7.2 Packing Specification

| Item                | Specification  | Remark                                                                                         |
|---------------------|----------------|------------------------------------------------------------------------------------------------|
| LCD Packing         | 24ea / Box     | 1. 259.2 Kg/ LCD (24ea)<br>2. 12Kg/ Cushion pallet (2ea)<br>3. 8 Kg / Packing pallet box (1ea) |
| Pallet              | 1Box / Pallet  | 1. Pallet weight : 8.8Kg                                                                       |
| Packing Direction   | Vertical       |                                                                                                |
| Total Pallet Size   | H x V x height | 1270mm(H) x 1150mm(V) x 844mm (height)                                                         |
| Total Pallet Weight | 288Kg          | Pallet + Module + Cushion + Pallet box                                                         |

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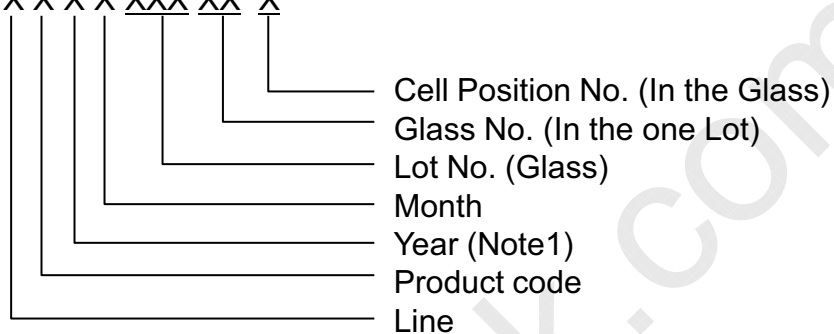
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**Samsung Secret**

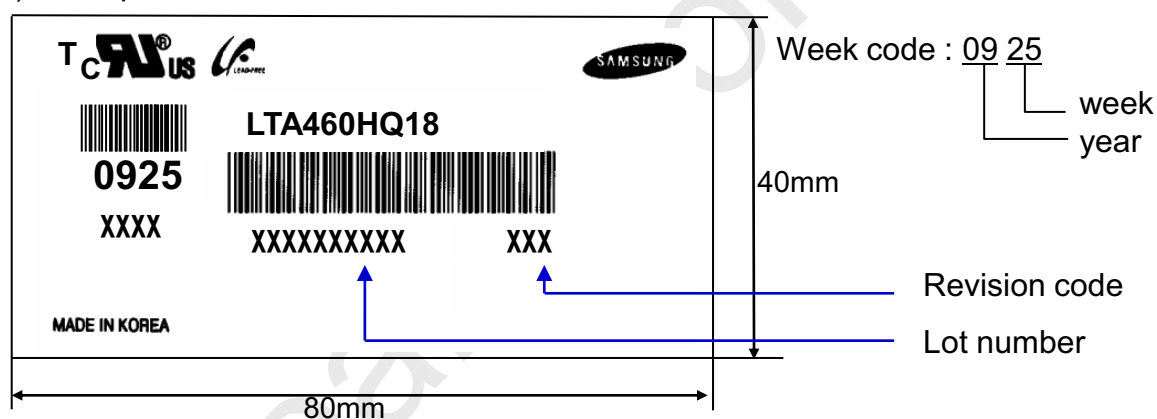
## 8. MARKING & OTHERS

A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

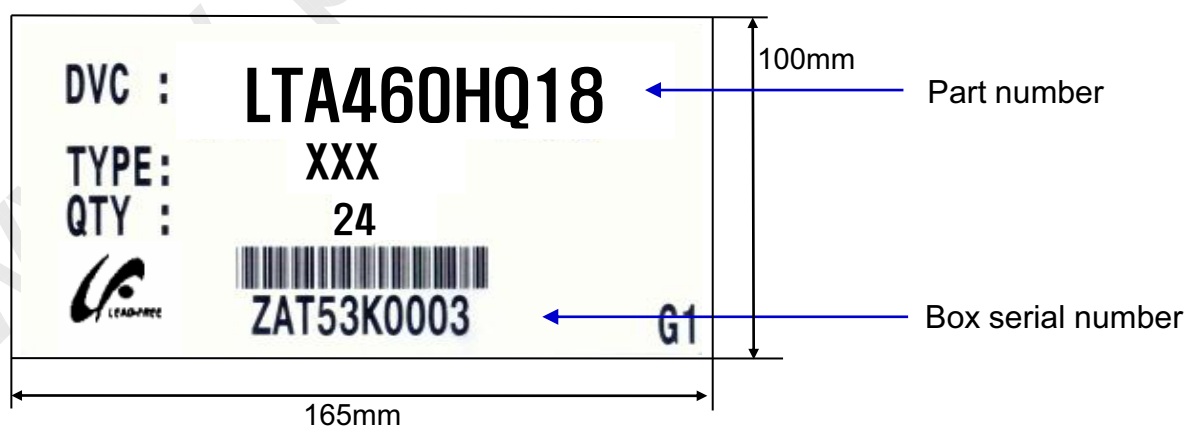
- (1) Part number : LTA460HQ18  
 (2) Revision: Three letters  
 (3) Lot number : X X X X XXX XX X



### (4) Nameplate Indication



### (5) Packing box attach



### (6) Others

1. After service part

Lamps cannot be replaced because of the narrow bezel structure.

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## 9. General Precautions

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### 9.1 Handling

- (a) When the Module is assembled, it should be attached to the system firmly using all mounting holes. Be careful not to twist and bend the Module.
- (b) Because the converter use high voltage, it should be disconnected from power before it is assembled or disassembled.
- (c) Refrain from strong mechanical shock and / or any force to the Module.  
In addition to damage, this may cause improper operation or damage to the Module and LED back light.
- (d) Note that polarizers are very fragile and could be damage easily.  
Do not press or scratch the surface harder than a HB pencil lead.
- (e) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining or discoloration may occur.
- (f) If the surface of the polarizer is dirty, clean it using absorbent cotton or soft cloth.
- (g) Desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane.  
Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
- (h) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth . In case of contact with hands, legs or clothes, it must be washed away with soap thoroughly.
- (i) Protect the module from Electrostatic discharge. Otherwise the ASIC IC or semiconductor would be damaged.
- (j) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (k) Do not disassemble the Module.
- (l) Do not disassemble shield case of converter & LVDS board
- (m) Do not connect N.C pins. (Samsung internal use only)
- (n) Protection film for polarizer on the Module should be slowly peeled off just before use so that the electrostatic charge can be minimized. Must put on antistatic glove while handling a module
- (o) Pins of I/F connector should not be touched directly with bare hands.

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## 9.2 Storage

| ITEM                | UNIT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Min. | Max. |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|
| Storage Temperature | (°C)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 5    | 40   |
| Storage Humidity    | (%rH)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 35   | 75   |
| Storage Life        | 12 months                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |      |
| Storage Condition   | <ul style="list-style-type: none"><li>- The storage room should provide good ventilation and temperature control.</li><li>- Products should not be placed on the floor, but on the Pallet away from a wall.</li><li>- Prevent products from direct sunlight, moisture nor water; Be cautious of a build up of condensation.</li><li>- Avoid other hazardous environment while storing goods.</li><li>- If products delivered or kept in conditions of over the storage period of 3months, the recommended temperature or humidity range, we recommend you leave them at a temperature of 20 °C and a humidity of 50% for 24 hours.</li></ul> |      |      |

## 9.3 Operation

- (a) Do not connect or disconnect the Module in the "Power On" condition.
- (b) Power supply should always be turned on/off by the "Power on/off sequence"
- (c) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference should be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.
- (d) The cable between the back light connector and its converter power supply should be connected directly with a minimized length. A longer cable between the back light and the converter may cause lower luminance of LED package and may require higher startup voltage(Vs).

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## 9.4 Operation Condition Guide

- (a) The LCD product should be operated under normal conditions.  
Normal condition is defined as below;
- Temperature :  $20 \pm 15^{\circ}\text{C}$
  - Humidity :  $55 \pm 20\%$
  - Display pattern : continually changing pattern (Not stationary)
- (b) If the product will be used in extreme conditions such as high temperature, humidity, display patterns or operation time etc., It is strongly recommended to contact SEC for Application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at Airports, Transit Stations, Banks, Stock market, and Controlling systems.

## 9.5 Others

- (a) Ultra-violet ray filter is necessary for outdoor operation.
- (b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.
- (c) Do not exceed the absolute maximum rating value. ( supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on)  
Otherwise the Module may be damaged.
- (d) If the Module keeps displaying the same pattern for a long period of time, the image may be "sticked" to the screen.  
To avoid image sticking, it is recommended to use a screen saver.
- (e) This Module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.
- (f) Please contact SEC in advance when you display the same pattern for a long time.